NEVINS

The Modern Railway Terminal for Passengers

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THE MODERN RAILWAY TERMINAL
FOR
PASSENGERS

BY

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THESIS

FOR THE

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THIS IS TO CERTIFY THAT THE THESIS PREPARED UNDER MY SUPERVISION BY

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IS APPROVED BY ME AS FULFILLING THIS PART OF THE REQUIREMENTS FOR THE

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Bibliography.

1- The Railway Age Gazette, 1905 - 1913
2- The Railway and Engineering Review, 1907 - 1913
3- International Railway Congress Association
1909 - 1910.
4- The Railway World, 1905 - 1913.
5.- The Railway Gazette.
6 - The Railway Journal 1909
7- Scribner's Magazine, January 1913
8- The Railway Magazine (English)
9- The Chicago Daily Tribune, May 1913.
10- The Railway Age.

Outline of Thesis in Brief.

A-Introduction.
- ① - Importance of our terminals, due to
  - ⓐ - public sentiment.
  - ⓑ - growth of cities.
- ② Purpose of Thesis - consideration of questions of location, capacity or size, design and operation, and finance.

B- Location of Terminal. Factors are.
- ① - The railroad as an obstacle to traffic.
- ② - Intramural transportation.
- ③ - Nature of the traffic, whether
  - ⓐ - suburban
  - ⓑ - through.
- ④ - Aesthetic point of view.

C- Size of a Station, determined by.
- ① - The present maximum volume of traffic
- ② - The expected growth of traffic.
- ③ - Character of the traffic.
- ④ - Effeciency of the facilities.

D. Design of the Terminal. Effect of conditions
- ① - Distinctive Architecture of Building.
- ② - Utility versus Artistic Effect.
  - ⓐ - lighting
- ③ - New Ideas in Design.
  - ⓐ - Train sheds - change of types

(b) - Raised track platforms

(c) - Ramps.

(4) - Station Heating.

E. Arrangement of the Station.

(1) Objects are

(a) - comfort and convenience of passengers.

(b) - expeditious despatch of business.

(2) - Factors determining arrangement.

(a) - topography of the city.

(b) - volume of the traffic

(c) - character of the traffic.

(3) - Questions of operation, handling of mail, baggage, and express

F. Financial Considerations, problems are

(1) Should so much money be spent on railway terminals for passengers?

(2) - Should large terminals be built?

G - Conclusion -

Introduction.

Although it is to public sentiment, the insistent demand of the people, that we owe in a measure our new passenger terminals, nevertheless the tendency which has exercized the greatest influence in securing for us the modern passenger Terminal is the growth of our cities. ① The population of our municipalities has doubled within the last two decades. Twenty years ago only three of the present eight cities having over five hundred thousand population could boast that number. Thirty years ago we had only one city of more than one million people; now there is one city with one million, five hundred thousand, one

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① - The Problem of the Modern Terminal
Scribner's Magazine 1913 January.

with two and a quarter millions, and one with five millions. This wonderful increase in our city population has more than a direct effect upon the passenger traffic that passes through our great stations. Travel increases more rapidly than increase in population. ° The number of passengers using the stations in New York has increased about seven times while the city has merely doubled in size. A conservative estimate, according to Samuel O Dunn, places the increase in passenger traffic through city stations at about four times the increase in our citie's population throughout the country. All classes of traffic have been growing at a rate which has defied the prescience of the most farseeing. The increased facilities obtained by

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° The Railway Age Gazette, April 1910.

rebuilding the Grand Central terminal in New York ten years ago were expected to prove ample for the next twentyfive years. The Union station in Chicago, which, thirty years ago, was pointed to as the zenith in railway passenger terminal construction is low, dirty, and entirely inadequate according to present standards.① Mr Delano, President of the Wabash Railroad Company, says that it has proven impossible to provide terminal facilities which shall remain adequate for more than twentyfive years.

The importance of the railway terminal problem is readily seen upon examining a few of the following figures. The new Northwestern station in Chicago handles fiftyone thousand people a day, the equivalent in

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Railway Age Gazette, 1909.?

fortyfour days of the whole population of Chicago. Over sixtysix thousand daily use the Grand Central terminal in New York About eighty thousand passengers pass each day through the Pennsylvania Broad Street Station in Philadelphia; and the number using the New York, New Haven, and Hartford South Station in Boston is over one hundred thousand daily. Three hundred passenger trains each day are required to deal with the traffic at the Northwestern Station; to handle that at the Grand Central Terminal, four hundred and thirteen a day; to take care of the passengers at the Boston South Station, seven hundred and seventynine trains every twentyfour hours, or an average of more than one every two minutes. Such facts give us but a faint conception of the size and complexity

of the problem presented in the modern railway terminal. But it will remain an inadequate conception until we consider some of the conditions that affect the terminal's location, capacity, design, arrangement and operation. It is the object of this thesis to discuss these problems.

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In the first place, in order that our use of the word terminal may be perfectly clear, it should be understood that a terminal, as we shall discuss it, is not necessarily the end of a line. The distributing point for the passenger traffic of any city of one hundred thousand population, whether stub-end or through, is a passenger terminal. The station in Albany, New York, and the proposed station in Cleveland, Ohio are as much terminals, in this definition of the term, as are the

stations in New York, Chicago, or Boston. It is not the geographical position of a city which in itself determines whether or not the station is a terminal; it is the size of the city and the volume of the traffic.

Location of the Terminal.

In a city of any marked size, the location of the station is of the utmost importance, and demands the consideration of the following factors; the railroad as an obstacle to traffic, intramural transportation, the nature of the traffic, and the aesthetic "point of view". It is not always recognized that a railroad, primarily a means of transportation, is often a serious obstacle to traffic within a city. For the location of the station depends not only upon questions of convenience and comfort of the patrons and the adaptability of the location to

the needs of the railroad, but also upon the street plan of the city. Frequently, the railroad, in building the station to meet existing conditions finds itself confronted by a very difficult situation.① An excellent example of this condition is found in the Saint Michel station of the Paris Metropolitan Subway. The station had to be built under one of the boulevards of Paris in water soaked ground. The work had to be done by means of cassions sunk vertically, cassions like coverless boxes with air tight walls entirely surrounding the work. They were first built over the place where they were to be sunk, with a working chamber at the bottom to allow the laborers to excavate underneath the cassion, which was sunk progressively by its own weight as the spoil was removed.

Railroad Gazette, May 8, 1908 (E. Ommeganck)

Passage of men and materials back and forth between the upper part of the cassion with normal air pressure and the lower part under compressed air, was made through air locks at the end of vertical shafts. This is only one example out of hundreds which would illustrate the difficulties of locations, even the best locations that could be selected.

① In a city of under one hundred thousand population, it is generally agreed that the station should occupy a central position, unloading the passengers near the center of the business district. In our larger cities, however this is much less desirable. ② It is extremely doubtful if, in our largest cities, according to President F. A. Delano of the Wabash road, the

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① - Scribner's Magazine, January 1913

② - Railway Age Gazette, 1909 ?

stations, except stations used for suburban traffic, should be located near the business center. An adequate railway terminal takes up both directly and indirectly a great amount of space, requiring the closing of streets and interferring with the growth and development of a city. "A terminal may be viewed as a great river or a broad canal, both as an artery of traffic and as an obstacle, for, although it can be passed over and under more readily than a river, it necessarily forms a very important obstacle to any growth or development." ① The fight in Chicago for new terminals, or a new union terminal, is a direct result of this fact. There are now six principal stations in Chicago which own something like two hundred and

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① The Chicago Daily Tribune May 28, 1913

fifty acres in the heart of the city, nearly one-third of the available area. Such a condition means that these railroads have become obstacles to the development of the city. The situation affords an interesting question - there being six principal stations in Chicago, at least four of which will have to undertake a large expenditure for terminal improvements within the next few years, is it right that these railroads be allowed to work out independent solutions? The result seems inevitable that, in the end, the railroads entering Chicago will have to conform to the pressure of public opinion - again we have an example of one of the many problems affecting the location of a large station.

Having touched upon the question of the railroad's relation to the city as an obstacle to the civic growth

or development, we must pass to the second factor, intramural transportation, which is almost inseparable from the first consideration. A station which is readily accessible from all parts of the city by street car lines, will best serve the public convenience; and if there be more than one terminal, the railway using a terminal so accessible has a great advantage over the railways using stations which are less favorably situated.① The very excellence of a station's location in respect to intramural transportation, however, usually necessitates a limited capacity for expansion. Such is found to be the case in the Pennsylvania and the Philadelphia and Reading Terminals in Philadelphia. These stations are advantageously located for every part of the city, but are now unable to

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Scribners Magazine Jan. 1913 Samuel O. Dunn.

expand to meet a fast growing business. Turning again to Chicago we find an excellent example of poor terminal location for intramural transportation. Twentyfive trunk lines enter the six main terminals, coming in from every direction, and having no harmonious relationships. The La Salle street station, which is on the loop, is the only station which is favorably located for the traveller.

In the third place, there is an important relation between the location of the station and the nature of the traffic.① According to Samuel O. Dunn, if the traffic is chiefly suburban, the terminal must be situated in or near the downtown business district; for commuters always object to paying more than one fare between business and home. If, on the other hand, the

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Scribner's Magazine January 1913

the passengers are mostly through passengers, they will require the assistance of street cars and taxicabs as they come and go with their heavy luggage, and the station may be farther out.① It is interesting to note here that in London, England, the terminal stations are aggregations of many small units rather than a large single development. Stations such as those at Paddington, Euston, Saint Pancras, Liverpool Street and Charing Cross are really a collection of several little stations operating more or less independently. Such a system results in great freedom and facility of individual movement, the passenger arriving at a London terminal finding his baggage on the platform almost adjacent, and cabs, express, etc. only a few steps away. We have some doubts, after

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The English Railway Magazine 1907?

noting the facility of the English methods, as to the success of our policy in America of erecting such immense stations.

The fourth and final factor, the aesthetic point of view, is often underrated. Public opinion generally insists that a railway terminal station shall be so located as well as so constructed that it shall be an object of pride in the city, and an ornament to the city architecturally. In Chicago, the plans for a "city beautiful" were what stirred up the minds of the people to a realization of the poor condition of the railway facilities, and authorities do not doubt that public opinion will be able to rule the railroads in the end. The pride and artistic taste of a community naturally find gratification in handsome structures commanding good

positions in the city, and approached by broad streets; and a railway usually finds it profitable to cater to the public demand.

Size of a Station.

Perhaps it has already been foreseen that a very close relationship exists between the location of a passenger terminal and its size. The size of a terminal is determined mainly by these considerations: the present maximum volume of traffic, the expected growth of the traffic, the character of the traffic (whether or not it tends to congest the station at certain hours), and the effeciency of the facilities to be contained in the station. Obviously, the station must accomodate the maximum volume of traffic. Herein lies a point of economy.① It must be borne in mind that the capital

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① The Railway Age 1906

invested in a passenger station in excess of the amount to provide adequate and proper facilities for handling the maximum volume of traffic that shall come to the station is unproductive. It brings in no return and the interest upon it is a constant loss.① The union station in Washington is an excellent example of this condition of economic waste. The facilities there are fully used only for a few days every fourth year. In the meantime, the cost of operation and maintenance, including the fixed charges on the capital investment, is a heavy burden on the railroads using the station, and all without bringing them an additional dollar of revenue. On account of the peculiar conditions this cost cannot be criticized as could be done were the station situated in the ordinary city. Many

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① Railway Age Gazette, "Washington Station", 1906.

railroad men of high standing do consider the erection of such a terminal unwarranted. ① The following quotation may be found in the December Railway and Engineering Review for 1908: "It has been impossible to learn of any reasonable excuse for a terminal and station of the proportions of the union station at Washington under present traffic conditions there." At any rate, we see here an example of the dangers, in an economic sense, of an excessively large station so constructed as to take care of the maximum volume of traffic. The second consideration, the expected volume of traffic, is also of the greatest importance in determining the size of the station. Time and again new stations have been built that have seemed to provide facilities for the wildest growth of business of which the most optimistic

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① Railway and Engineering Review, December 1908

officials could dream, only to become crowded and in need of expansion within ten years. As was stated before, it seems impossible to provide for future growth for a period longer than twenty-five years. ① The Northwestern station in Chicago shows the effect of this consideration — the capacity of the station is at least a quarter of a million people daily, although at present it handles but about fiftyone thousand passengers a day on the average. ② The total area of the waiting room provided for the public in the New York Central's new terminal in New York is six acres, and thirty thousand people can be accommodated at one time without crowding. It is true that to provide for so great an increase in business lays a

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① - Pictoral description of Northwestern Station in Chicago, by Chicago and Northwestern Railway.

② Railway World, February, 1913.

road open to the criticism of imposing upon itself the burden of an excessively large station, but it is equally true that future growth must be provided for. ①The policy of the English railroads which has already been mentioned, that of erecting a group of small stations rather than one immense structure, enables them to deal more easily than we with this problem. Their stations do not become useless so quickly, and they are not put to so great an expense when they must remodell a station. As the saying goes, they have not "put all their eggs in one basket". The third factor, the character of the traffic, whether or not it tends to congest the station at certain hours, is of obvious importance. Those stations where suburban traffic predominates,

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The English Railway Magazine 1907?

where the rush of the business is at the times of going to and from work in the morning and evening, must, of course, provide a larger sized station or better facilities than those stations which have the same total traffic scattered evenly throughout the day.① The ideal arrangement is a regularity of train movement throughout the day, but this is seldom possible, because of the conditions of the traffic.② The final factor of the four main factors as given by Mr. W. W. Findley, President of the Southern Road, the effeciency of the facilities, seems equally clear. The size of the station naturally depends upon the rapidity with which passengers, baggage, and mail is discharged. Bound up in this factor are problems of arrangement, of the effeciency of certain

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①- Samuel O. Dunn - Railway Age, 1908.

②- Railway and Engineering Review, 1910.

competing facilities. These will be treated later under arrangement and operation.

Closely related to the location and size of a large station, and thus enforcing discussion here, is the bearing which the total area of the terminal has upon the choice of a site.① It must be remembered that the station building, however handsome and imposing is but a small part of the entire terminal, with its train sheds, its approach tracks, its interlocking plant, its yards for storing and cleaning coaches and for making up trains, its power and light plants, and its baggage and mail handling facilities.② The area acquired by the Chicago and Northwestern Railway Company for their new station in Chicago was thirtyseven acres, and the area covered with buildings is twenty acres. In the Pennsylvania's New York Terminal

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① Scribner's Magazine, January 1913.

② Pictorial phamphlet of the Chicago Northwestern Sta.

there are sixtyfour buildings given solely to terminal uses. In this connection it may be said that electrification, which is too large and independent a subject to be treated in this thesis, is a solution for this problem. By depressing the tracks and doing away with the train sheds a great area is saved. ① The New York Central reclaimed about twenty city blocks by electrifying their New York terminal. ② The Kansas City terminal, which is a union station centrally located covers fiftyone acres. ③ The Chicago terminals, as has been indicated before, occupy about two hundred and fifty acres in the heart of Chicago. Such are a few examples indicating the great size of the terminal as a whole. Although

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① - The Railway World, February 1913.
② - The Railway Journal, September 1909.
③ - The Chicago Daily Tribune, May 28, 1913.

this thesis is concerned with only the passenger side of the terminal problem, the great area necessary to accommodate the entire terminal has an important influence upon the location of the station, and therefore should be touched upon here.① To find in or near the business district in the congested part of a large city, such an area suitable for any purpose is hard; to buy it, very costly. And the purpose of the terminal aggravates the problem. The terminal must be readily accessible by operating tracks, and the topography of a city may make almost inaccessible by tracks a location which is otherwise excellent.

Design of the Terminal

After the location and size of the terminal has been determined, there is next the problem of design to be met.

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① - Scribner's Magazine, January 1913.

Conditions vary so much that only a few general conclusions as to design may be made. Topography is one of the most important factors in terminal design; its effect, however I shall discuss under the subject of the arrangement of the station. Climate is another factor of great influence. The design of Southern stations is quite different from that of station buildings in the North. ①In general, the treatment of the exterior of a passenger station should be such as to produce a distinctive building, so that a stranger approaching it need not be told that it is a railway station. ② One of the two principal ideas in the building of the Pennsylvania Railroad in New York is "to express in so far as was practicable, with the unusual condition of tracks far below

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① - Railway and Engineering Review 1910

② - The Railway Journal, September 1909.

the street surface and in spite of the absence of the conventional trainshed, the exterior of a great railway① station in a generally accepted form." Mr. W. W. Finley, the President of the Southern Road, speaks of the failure of the architects to produce a distinctive and appropriate design when his company asked for plans for a proposed station." In several of the designs submitted, he says, " the exteriors would have been admirable for seashore hotels, but were altogether unsuited for a passenger station." In spite of the theory that a building should exclusively express its uses, however, ② many of the finest stations in the world stand as much for the majesty of a great city and a welcoming portal as for a strictly utilitarian railway passenger terminal.

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① - Address before Assn. of Architects R. + E. Review?

② - Scribners Magazine, January 1913.

The union station in Washington reflects in its grandeur the architecture of the capitol buildings.① In Cleavland, Ohio the railways are cooperating in a general plan for the city which is the most comprehensive and successful system for the city's development yet attempted in America. The Gare d'Orléans in Paris, situated on a quay of the Seine, directly opposite the historic Louvre, is, in the opinion of many, the most distinctive railway entrance to any city yet achieved.② Yet surely artistic effect should be subordinated entirely to utility. Locomotive smoke and dust are inevitable in the vicinity of a railway station, and all sorts of men, women, and children use it. The matter of clenliness is something that should be absolutely insisted upon. As far as

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① - Scribner's Magazine, January, 1913.

② - Railway and Engineering Review, 1910?

possible, carvings should be avoided, as well as moldings, ledges and other projections that tend to catch and retain dust and dirt. Again in the matter of lighting, artistic effects often flourish at the expense of utility. Marble finish, elaborate chandeliers, and expensive ceilings that are bewildering in their detail give but very little satisfaction to the average traveller, who finds the interior as dark as a dungeon.① The Union station in Schenectady, New York is pronounced by experts to be one of the best lighted stations in America. The main waiting room is lighted by General Electric Arc lamps, equipped with concentric diffusers. The concensus of opinion is that, although with diffusers the intensity of illumination is relatively

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Railway World, June 12th, 1908.

quite low, it is easier to read or to see any object in the room, and the general effect is more restful than direct illumination. On the whole, however, lighting is one of the most simple problems of the station, but the result would doubtless be more satisfactory in many terminals if more common sense and less artistic design went into the solution.

① A prominent feature of the design of old terminals that is disappearing is the high vaulted train shed, in which smoke and gas often accumulate to the discomfort of the passenger, and which is extremely hot in warm weather and not altogether comfortable in cold weather. ② As was illustrated by the case of the New York Central's new terminal in New York, electrification does away

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① - Scribner's Magazine.

② - Railway World, February 1913.

with the train shed entirely. Even in the terminals which use steam power, however, other forms are displacing the high, vaulted shed. In many stations the inverted umbrella type is being built.① Especially is this true of Southern stations, and there it is without doubt more satisfactory than the ordinary trainshed, and, from the standpoint of initial cost and maintenance, is of course in high favor with the railway companies. It is cool and airy, and smoke and gas do not bother at all. The New Union Station Co. at New Orleans has built this type of shed, as well as the roads operating the Union Station in Salt Lake City, The Union Station in Washington, and many others. The pen sketch on the following page illustrates the type

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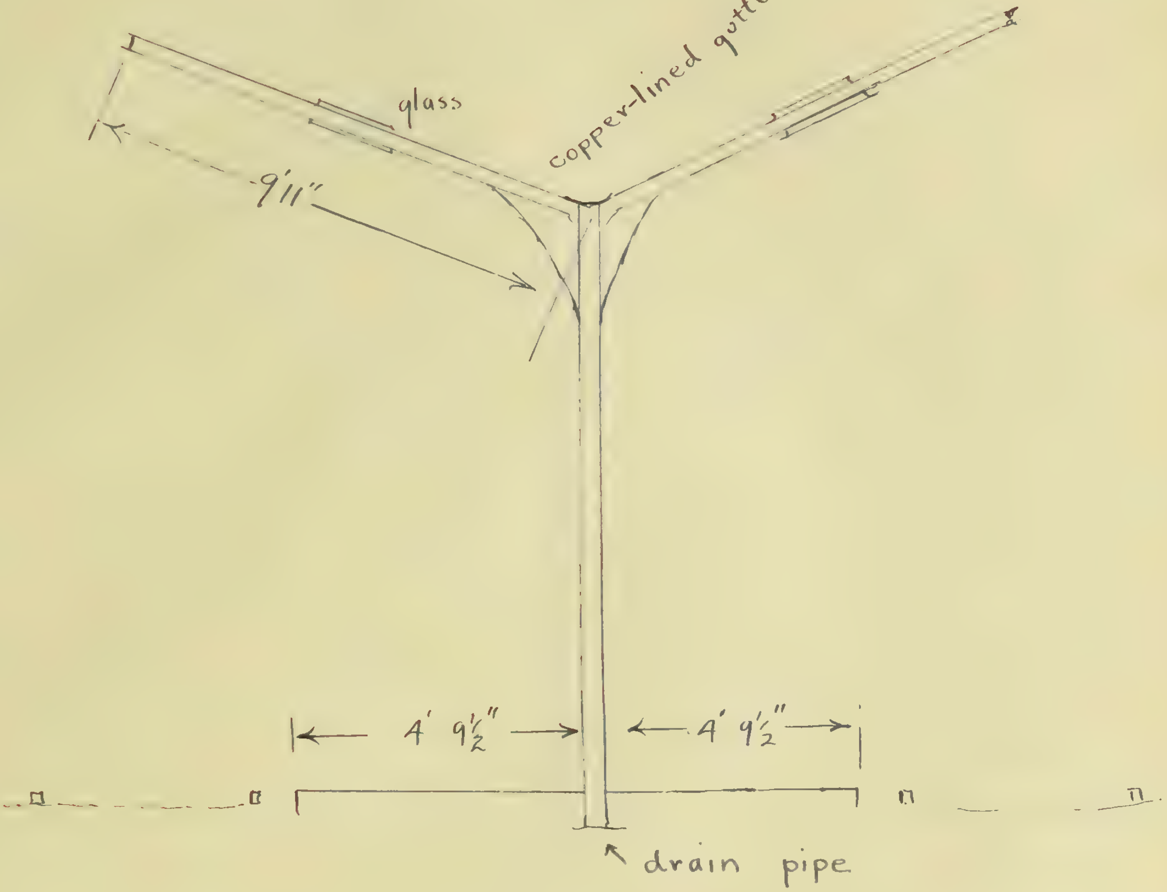
Railway Gazette, May 1908

erected in the New Orleans Union Station.



In such an inverted umbrella shed, all objectionable features, notably the common annoyance from drippings, are eliminated. The low point is in the middle over the supporting columns, and the sides extend well out over the cars. The other type of umbrella shed, for there are two, is usually called the "A"

construction. The highest point of this train shed is the middle, and the lowest is the edge directly over the cars. It is not so satisfactory as the inverted type because of the drippings from the eaves. ① On the whole, however since the main purpose of a train shed is to afford protection from rain, snow, wind, extreme heat, and extreme cold, its value is, as has been indicated largely a matter of climate. Where the inverted "butterfly" type of shed is not satisfactory, a new type is coming into use, the "Bush" train shed. ② This type was introduced by the chief engineer of the Delaware, Lackawana, and Western railway in their station in Hoboken, and has since been copied by the Northwestern in Chicago, the Kansas City Union Station,

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① - Scribner's Magazine? - Samuel O. Dunn.

② - Railway Age Gazette? 1911 (Trainsheds).

the new-terminal in Winnipeg, and many others. The following pen sketch shows the main features of the "Bush" train shed as it is at the Northwestern Station in Chicago.

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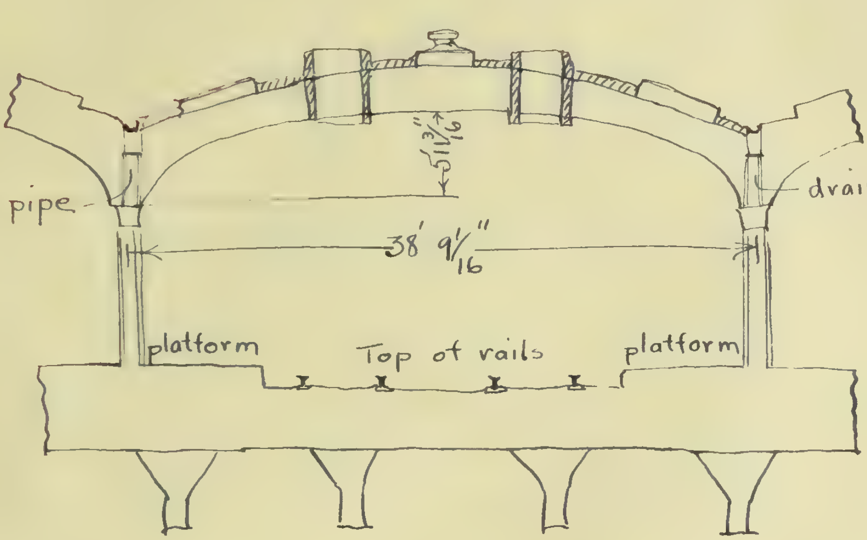

② The top of this shed is barely higher than that of the locomotive smoke stacks, and is slotted just above the stacks to allow gas and smoke to escape. The protection from the weather is ample, yet smoke, soot, and gases do not annoy the passengers. Another point of design which may be mentioned as a convenience,

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① Pictorial booklet of the C. & N.W. RR.

② - Scribner's Magazine.

of some importance, and which is closely related to the design of the train shed is the raised track-platforms.① The Pennsylvania terminal in New York introduced platforms which are level with the floors of the cars instead of only eight or nine inches above the level of the rails. Not only has this innovation proved a great convenience to the patrons of the station, but, what is of equal importance to the railroad, it has also increased the effeciency of the station. It has shortened the time required to unload the passengers from a suburban train from over one minute to forty seconds, a saving of thirtyfive percent in time.

② A second unusual feature in the design of the Pennsylvania terminal is the partial elimination of stairways

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① - Railway Gazette May 1908

② - Railway Journal Sept 1909

which is accomplished by the use of ramps or inclined ways. These ramps or grades are infinitely better than stairways, which are not only somewhat of a nuisance but also a danger. They are determined by a number of interesting experiments.—Temporary ramps are built, and all sorts of people—fat men with suit cases, lean women wearing long skirts, and with their arms filled with bundles, school Children with books — walked up and down them, and as a result, very easy grades are established.

Although not a question of station design, station heating is an important matter, and there are some general conclusions regarging the question that can best be given now before arriving at the problem of station arrangement. There has been some doubt as to the relative economy of the various systems, and Mr. J. F. Canty, in a paper which he has prepared in his capacity as Superintendent

of Bridges and Buildings of the Boston and Maine Railroad, gives the following table of expense, which should go a long way toward settling the question.① For "class A" stations, those buildings of sub-construction having cellars, the sole type with which this thesis has attempted to deal, the average cost for the fuel heating one cubic foot of space for one year is as follows:

Hot Water ——	.460¢
Hot Air	.576¢
Steam	.593¢
Stoves	.605¢

"At the same time", says Mc Carty, "neither the hot air nor the stoves are very efficient, and leaving out the matter of cost, people invariably prefer hot water". Therefore, both from the standpoints of comfort and economy of operation, according

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① Railway and Engineering Review, 1910

to Mc Canty, there should be little doubt that hot water is the best solution of the heating problem of the large station.

Arrangement of the Station

After the general design of the station has been determined, or frequently in connection with the problem of general design, there arises the question of the arrangement of the station. There are two prime objects to strive for, the comfort and convenience of the public, and the convenient and expeditious despatch of the business of the company.① Moreover, in securing these results, there are three important factors entering into the equation, the topography of the city in which the station is to be located, the volume of the traffic, and the character of the traffic. Perhaps the greatest of these factors

① Railway and Engineering Review, 1910.

in the determination of the arrangement of the station is topography. The topography of the city is usually the prime factor in determining whether or not the tracks shall enter the station below the street level, on the street level, or above the level of the street. And upon this arrangement rests the greater part of the station arrangement. ①Where the topography is such that the tracks are depressed, the ground floor is almost always used for baggage and express rooms, and the waiting rooms, ticket offices, restaurant, etc., are on the first floor or street level. ②Such is the arrangement in the new Union station in Kansas City; "the baggage, express, and mail rooms are on the track level (on the lower floor of

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① Railway and Engineering Review 1907; Inter. RR Cong. 1910.

② Railway Age Gazette, 1908

the main building) with elevators and chutes to subways serving the several platforms.① Other stations having this arrangement are the Orléans station in Paris, The Pennsylvania station in New York, The New York Central's station in the same city, and the Pennsylvania station in Pittsburg.② On the other hand, if it is necessary to elevate the tracks, the waiting rooms, ticket offices, restaurant, etc., occupy the lower floor, and the patrons ascend stairways or ramps to the concourse on the track level.③ Such is the arrangement in the new Northwestern station in Chicago.④ The Winnipeg station illustrates a third arrangement. It is constructed with the tracks on the street level, as are also the waiting rooms,

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① - Scribner's Magazine, 1913

② - Railway and Engineering Review, 1909

③ "Pictorial booklet" of Northwestern Station.

④ - Railway Age Gazette, July-Dec. 1911

ticket office and restaurant, and the baggage, express, and mail rooms are located underneath the passenger tracks. ① The differences in the topography of cities, and the effect upon the stations is well told by Samuel O. Dunn; the following is a brief summary of his work. The topography of Chicago — with its flat surface — like that of hardly another American city but Detroit or perhaps Buffalo, makes it possible for railroads to enter almost anywhere and arrange their stations as they please. Strikingly different is the topography at Kansas City, Seattle, and Cincinnati, with every difficulty for the location and arrangement of the stations. The Oakland Pier terminal is unique in location and arrangement, running far out from Oakland into the pier-topped Bay of San Francisco. More than one thousand, two hundred trains run off this pier each day, the Passenger passing between it and

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① Scribner's Magazine.

San Francisco on ferry boats. New York, bounded by the Harlem, North, and East Rivers, and a great harbor presented a difficult problem to the railroads, and depressing the tracks as has been done by the New York Central and Pennsylvania roads has been the successful solution. ① The Pennsylvania station is designed to give the greatest number of lines of circulation, and in this respect at least, is one of the best arranged stations in the world. It affords the maximum amount of entrance and exit facilities possible, having entrances on its main axes and on all four sides. Such are a few of the examples which show the effect of topography upon the arrangement of the station and the manner in which the problem has been met in certain places. The second and third factors, the volume and character of the traffic are also

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Railway Journal, September 1909.

very important. These factors are inter-dependant, for the volume of baggage and express depends a great deal upon the character of the traffic. It must be remembered that the passenger station; handles not the passenger alone, but also the baggage, express, and mail. ①If the character of the traffic is suburban no large ticket offices are necessary, for the suburban passenger buys a commutation ticket once or twice a month; no extensive baggage rooms are required, for he seldom has any baggage; and no large waiting rooms need be provided, for he desires only a roomy concourse through which he may hurry just at train time. The opposite is, of course, true for the through passenger. The importance of the facilities for the handling of baggage, express and mail cannot be

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① Railway and Engineering Review, 1910.

over-emphasized, but shall be discussed later under the question of Operation. The arrangement of the baggage and express rooms in relation to the track-platforms and the other parts of the station may well be discussed here. ① The general rules for the arrangement of baggage rooms in relation to the tracks, that is the floor arrangement (whether first or second floor) was indicated under the question of the effect of Topography upon the station. ②In the best stations, two large baggage rooms are provided, one for inbound and the other for outbound traffic. They are usually not on the level with the waiting room and train shed. The baggage is transferred to and from trains by elevators opening through the train-shed floor, thus avoiding trucking

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①- International Railroad Congress Bulletin 1910.

②- Railway and Engineering Review, November 1911.

on the passenger platforms, which is an evil that cannot be overemphasized. The passenger should by all means be spared the danger and annoyance of the trucking along platforms upon which he must walk to and from trains. At the same time such a condition is one of impaired effeciency for the railroad, for the baggage handling is slowed up appreciably by the interferance of the passengers. The new union station in Salt Lake City has been severely criticised in somewhat the following fashion, which illustrates the point we wish to make. ① There are seven tracks for through passenger traffic with island platforms between them and two local or terminal tracks are shown behind the station. The station is doubtlessly to be used by passenger trains in both directions, yet all baggage

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Railway Gazette, August? 1907

must be handled at the Western ends of the platforms, for such is the location of the baggage rooms. This means that the baggage to and from eastward trains, having the baggage cars in front of the passenger cars, must be conveyed almost the entire length of the platforms, apparently at grade, with great delay, expense of handling and inconvenience to the passengers. The handling of the passenger business is likewise poorly provided for. Connection between waiting rooms and the trains is apparently by a grade crossing of the tracks in front of the waiting room and by the island platforms. This practically restricts the station to handling one or not more than two trains at the same time, unless they are quite short, not over four hundred and forty feet long. This being the case, why are seven through passenger tracks needed? In

order not to be unfair, it should be stated that the management emphatically denies the truth of this criticism in respect to their station. However, the adverse criticism does illustrate the importance of this point in arrangement. Surely if this state of affairs existed the station's effeciency would be greatly impaired.① Poor arrangement of this character does exist in the Mount Royal station of the Baltimore and Ohio, and the Union Station in Baltimore, and the Pennsylvania terminal in the city of Altoona, Pennsylvania. On the other hand, if there are separate baggage platforms at one side of the train shed and baggage and express rooms apart from the main station, proper, no interferance is made possible.② The new station

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① Railroad Gazette August 1907.

② Railroad Gazette September 1907

— Evansvill, Ind-aina is well arranged in this respect. The Kansas City Union Station has its baggage, express, and mail rooms above the tracks with elevators, ramps, and chutes to subways serving the several platforms. The Seattle Union station has made good provision for baggage express and mail handling, having devoted the entire area of the track floor of the building to this purpose. Baggage is received both at the street floor (thence taken by means of elevators to the track floor) or may be delivered directly to the main baggage room by means of an incline permitting the driving of wagons from the street down to the track floor and thence under the viaduct to the depot building. The waiting rooms are on the street floor, and passengers descend stairways to the exclusively-passenger platforms, there being no interferance of baggage with the passengers.

The Ottawa Union Station illustrates another successful method of handling the baggage. Here the baggage and express is taken care of in a separate annex east of the train shed, three hundred and fifty feet long with separate tracks and platforms.

Operation

In connection with the problem of the arrangement of the platforms with respect to baggage and express rooms, it is interesting to note some of the facilities for handling the baggage, express, and mail.① These facilities are of the greatest importance because the train capacity of the tracks within a station depend largely upon the rapidity with which baggage and express, especially, are handled. It follows, therefore, that in order to handle the largest number of heavy trains within a given time, these facilities must be the best that conditions will permit. As was stated under the subject of arrangement,

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① Railway and Engineering Review November 1911

where it is possible to do so, baggage and express may best be received, delivered and handled below the train floor (the Kansas City Union station illustrates this arrangement), and raised and lowered by elevators located near the baggage and express cars. Theatrical express and other heavy baggage should be loaded prior to making up and placing the passenger trains on the tracks at the platforms, because passengers can be loaded much quicker than the baggage as a rule.

① The facilities for handling mail are well illustrated in their best form by the Pennsylvania terminals in New York and Philadelphia. In the latter city between two hundred and fifty and three hundred tons of mail are handled daily, there being between twelve and fifteen thousand bags. Four large plunger elevators provide

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① International Railway Congress Bull. 1910.

connection between the mailing platforms and the basement and train-platform levels. A maximum of twentysix mail cars are offered for loading at one time by four train platforms and six tracks, motor trucks with a capacity of four thousand pounds carrying the mail from point to point. The system of operation is as follows. Outgoing mail arrives, is fed into spiral chutes which deliver the bags to conveyor belts located at the track level above the mail cars. The belts are provided with automatic unloading mechanisms which may be set opposite the doors of any of the cars, thus unloading the mail into the car desired. Two belt conveyors are provided over each of the four mail-track platforms, and thus eight mail cars can be loaded simultaneously. For incoming mail openings are provided in the train platforms into which the pouches are

thrown from the arriving cars. Mail is transferred from these receiving hoppers by conveyor belts which in turn throw it into bucket elevators by means of which it is taken to the basement and mail-platform levels of the building. Such is a brief description of the mail handling facilities at this station, given merely to show the importance and the necessity for rapid and economical handling of mail, an item seldom considered in connection with the station.

Financial Considerations

Considering the question of the erection of terminals from purely an economic standpoint we are confronted with at least two serious financial considerations at the outset. In the first place, should so much money be spent on railway station buildings? How can this expenditure be justified in the light of

such statements as the following: ①"The Lehigh Valley could well afford to give the state of Pennsylvania five hundred thousand dollars per year to be relieved of the duty of operating passenger trains; Passenger business is conducted at a great loss on the Lehigh Valley road;" or ②"The average rate per passenger recieved per mile on all the lines of the Pennsylvania system for the year 1907 was one and ninetyone hundredths cents while the cost was one and ninetynine hundredths cents, a net loss per passenger per mile of nine hundredtths of a cent." These statments being true, is the railroad able to build such stations as are being erected in our large cities? Is the public justified in demanding such stations from the railroad? The cost of the New York Central terminal in New York is about two hundred million dollars; the Pennsylvania

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① - Railway World Jan. 31, 1903

② - Railway World, May 15, 1908, President McCrea.

terminal in the same city cost one hundred and thirteen millions; the Chicago and Northwestern in Chicago, thirty millions; the Washington joint Terminal, one hundred and seventyeight millions; and the Kansas City Union station expenditure was about fortyfive millions of dollars.① Mr. L. C. Fritch, chief engineer of the Chicago Great Western points out some interesting facts regarding some of these great expenditures. The New York Central Terminal expenditure represents two thousand miles of double track road at one hundred thousand dollars per mile. The Pennsylvania's terminals in New York, Baltimore, Philadelphia, and Washington represent an average of nearly eight hundred thousand dollars per mile for the two hundred and twenty-three miles from Washington to New York. Mr. Fritch figures that, after calculating the fixed charges of these terminals, the

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① Railway World, February 1913

gross passenger receipts accruing to the New York Central and the New Haven roads on their New York terminals on New York city traffic exceed these fixed charges only twenty percent; and that the fixed charges, depreciation, and operating expenses of the Pennsylvania terminal are equal to the entire gross passenger receipts originating in and around New York City. Such figures indicate that the railroads are building their magnificent stations at a loss. It is plain that in such cases, the railway corporations face the unpleasant economic necessity of a vast outlay of money to the interest charge on which the company must count its returns in fiscal vantages more or less remote from the station itself.① However, this is not true in all cases. If, for example, a railroad by building a new terminal of its own can escape a heavy

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Railway Age Gazette. 1910

annual terminal charge for trackage, as well as station privileges, paid to another company, the case is decidedly modified. If on the other hand, it is getting satisfactory terminal facilities for an annual payment which is a low interest rate on less than cost, it is a deterrent. ① In general, however, the dictum of high immediate expenditure and distant returns holds good. The nature of these remote returns is interesting and the instance of the Pennsylvania's New York terminal is a good illustration. The actual cost of this terminal, as was stated before, was one hundred and thirteen millions of dollars. On this sum the interest charges alone are over four millions with additions for operation, taxes, maintenance etc., of perhaps one hundred thousand dollars more than another million. The total cost yearly has been estimated at at least five million, five hundred thousand

① Railway Age Gazette 1910.

dollars, running alike in both good and bad periods for the railroad. As against this net charge there are important offsets. There are rents and station privileges sold; there is the rental paid by the Long Island railroad; there are potential economies in the great ferry service of the company; and incidentally the company will cover both central and downtown business. There is a possibility of an increase of a few cents per passenger of an immense volume of traffic. Such is the high bid for what is often termed "long distance" business made by the Pennsylvania railroad.① The terminal holding company which holds the South Station at Boston receives as revenue from the use of the station, itself, about three hundred thousand dollars a year, while the cost of maintenance and operation are about five hundred thousand per year. This

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Railway Gazette October 1906.

deficit of one hundred thousand dollars is augmented by about five hundred thousand more for interest on bonds and taxes. This makes a total deficit per year of over six hundred thousand dollars, and there is some question as to whether so large a terminal pays. In the end, as was indicated before such an outlay is a gamble, a bid for "long distance" profits. The second consideration we find confronting us is "Should such large terminals be built at all? ① Some railway men who have given much attention to the subject believe that future development will be along the line of the construction of more and smaller terminals located in various parts of a city and connected by subways. In London there are about twenty stations and English practice seems to tend toward building a greater number of terminals rather

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① Scribner's Magazine.

than larger sized ones. The average earnings from running a passenger train one mile is one dollar and thirty cents, while the fixed charges, operating expenses and taxes for a large terminal for each train run in or out varies from about seven to fourteen dollars. Hence, on this basis a train leaving a large terminal must run from seven to fourteen miles before it earns enough to pay the mere terminal expense involved in operating it.① According to Samuel O. Dunn, it is hard or impossible, on any basis of computation, to show that the railways earn any profit on their big terminals. At the same time the railroads, as quasi-public corporations, must render this service of hauling passengers, and great expenditures must be made whether the policy of large terminals is to remain our policy or whether the English policy is adopted.

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① Scribner's Magazine ?

Conclusion

In conclusion, there are not many principles that may be stated absolutely regarding the terminal. Much depends upon conditions, and conditions which vary infinitely. Little can be said without qualification. However, if there is one tendency which stands out above all others in terminal passenger operation it is probably that of segregation of traffic.①②③ Critics unite in urging that freight and passenger traffic be separated from each other, and through and local traffic be kept distinct.④ The New York Central Station in New York is pointed to as the latest exponent of this principle — in it, separate waiting rooms are offered for these classes of passengers.⑤ For suburban traffic the large central station is not desirable; the aim should be to distribute the traffic as early

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① Scribner's Magazine.
② Railway World Jan 1909.
③ Railway and Engineering Review 1907.
④ Railway Gazette 1902

as possible. The ideal through passenger terminal, however, would probably be described in these words. It should be of distinctive railway-terminal architecture, located so that it is readily accessible from all points in the city, with connecting streets which are ample and sightly, without interference of any freight traffic, having entire segregation of suburban and through traffic (assuming that there is some local passenger traffic), with utility, sanitation, and artistic effect combined with the prime requisites, Safety and Comfort.

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